Bottisham Village College

KNOWLEDGE ORGANISER

COMPUTER SCIENCE

ALL YEAR

KNOWLEDGE ORGANISERS

At Bottisham Village College, we are striving to create a five-year curriculum plan that builds effective revision strategies into homework and lessons, to ensure that students are able to place powerful knowledge into their long-term memories. Additionally, we hope that this will help build effective learning strategies from early in their time here at the college.

Based on evidence, we know that regular recall activities are the best way of achieving this goal and committing powerful knowledge into the students' memories.

At the start of each term, we shall publish all the knowledge organisers that students will require for their studies in each curriculum area. These will cover a range of aspects: facts, dates, characters, quotes, precise definitions and important vocabulary. We are clear: if this fundamental knowledge is secured, students can then develop their higher-level skills of analysis and critical understanding with greater depth.

They will be given an electronic A4 Knowledge Organiser (KO) booklet for each term containing all of the knowledge required. In lessons, Bottisham staff will be regularly testing this fundamental knowledge, using short-quizzes or even more formal "Faculty Knowledge Tests".

The best way to use these organisers at home, is to follow a simple mantra:

1. Look at a certain aspects of a particular knowledge organiser

2. Cover up part of their knowledge organiser

3. Write it out from memory

4. Check and correct any spelling mistakes, missing bits or mistakes

So simple but so effective.

J277/01: Computer systems. 50% GCSE Total—1hour & 30 minutes written paper exam (no calculators allowed) 80 marks

- 1.1 Systems architecture
- 1.2 Memory and storage
- 1.3 Computer networks, connections and protocols
- 1.4 Network security
- 1.5 Systems software
- 1.6 Ethical, legal, cultural and environmental impacts of digital technology

Please see course specification for further details HERE

Storage

- The need for secondary storage

- Data capacity and calculation of data capacity requirements

- Common types of storage:

- Optical
- Magnetic
- Solid state

- Suitable storage devices and storage media for a given application, and the advantages and disadvantages of these, using characteristics:

capacity, speed, portability, durability, reliability, Cost

Secondary storage

TYPE	CAPACITY	COST	SPEED	Pros	Cons
Magnetic	Very High	Low	Fast	Cheap and readily available. Can have very high storage capacity and is reliable	Slow read and write speeds. Moving parts make it susceptible to damage if moved. Data can be wiped if placed near a magnet
Optical	Low	Very Low	Slow	Cheap. Can be either Read or Read/Write.	Requires an optical drive to be read. Data corruption occurs over time (10+ yrs)
Flash / Solid State	Low	High	Very Fast	Much faster than magnetic drives. No moving parts, so hard to damage by movement. Silent.	Expensive and relatively low capacity. Has limited usable life – about 100,000 rewrites.

System Architecture

-The purpose of the CPU

- Von Neumann architecture:

- MAR (Memory Address Register)
- MDR (Memory Data Register)
- Program Counter
- Accumulator

- Common CPU components and their function:

- ALU (Arithmetic Logic Unit)
- CU (Control Unit)
- Cache

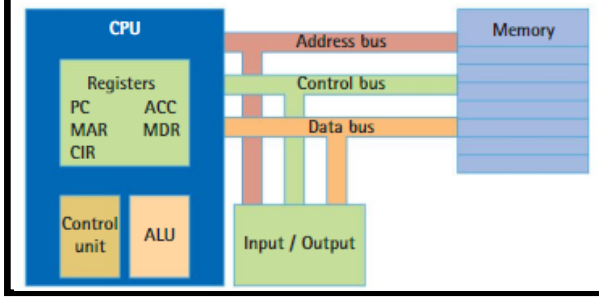
- The function of the CPU as fetch and execute instructions stored in memory (RAM or Virtual memory)

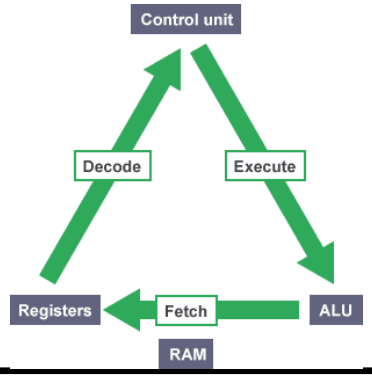
- How common characteristics of CPUs affect their performance:

- Clock speed
- Cache size
- Number of cores

- Embedded systems—a system designed for a specific purpose:

- Purpose of embedded systems
- Examples of embedded systems.





Memory

- The difference between RAM (Random access memory) and ROM (Read only memory)
- The purpose of ROM in a computer system
- The purpose of RAM in a computer system
- The need for virtual memory
- Flash memory.

Wired & wireless networks

- **Types of networks:**
  - LAN (Local Area Network)
  - WAN (Wide Area Network)

- **Factors that affect the performance of networks:**
  - Bandwidth
  - Latency
  - Error rate
  - Transmission media

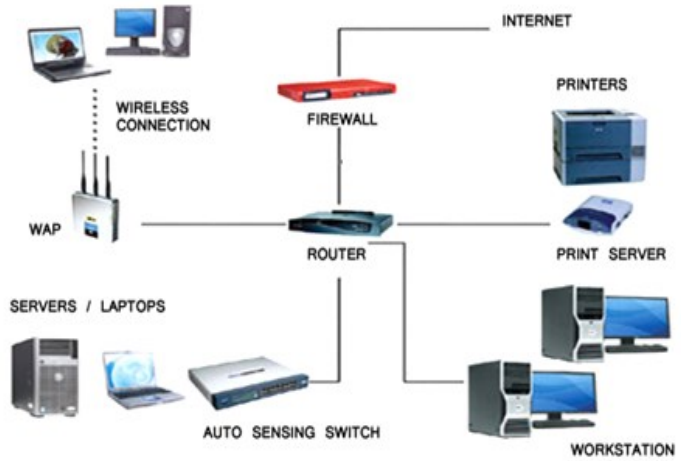
- **Different roles of computers in a network**
  - client-server
  - peer-to-peer network

- **Hardware needed to connect stand-alone computers into a Local Area Network:**
  - wireless access points
  - routers/switches
  - NIC (Network Interface Controller/Card)
  - Transmission media

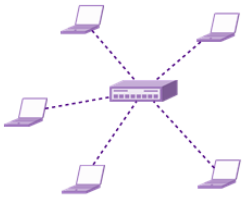
- **The internet & WWW**
  - Definitions of Internet & WWW
  - DNS (Domain Name Server)
  - Wen hosting
  - The cloud

Network topologies, protocols & layers

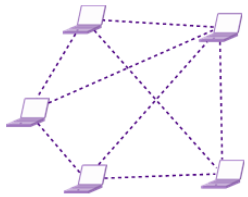
- **Star and mesh network topologies**
- **Wifi:**
  - frequency and channels
  - encryption
- **Ethernet**
  - Definition
- **Uses of IP addressing & MAC addressing**
- **Protocols:**
  - TCP/IP (Transmission Control Protocol/Internet Protocol)
  - HTTP (Hyper Text Transfer Protocol)
  - HTTPS (Hyper Text Transfer Protocol Secure)
  - FTP (File Transfer Protocol)
  - POP (Post Office Protocol)
  - IMAP (Internet Message Access Protocol)
  - SMTP (Simple Mail Transfer Protocol)
- **Layers**
- **Packet switching.**

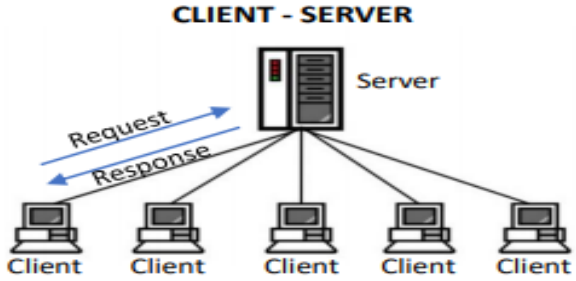


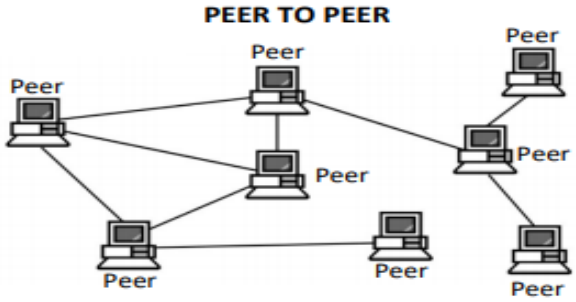
Star Topology



Mesh Topology







System Security

- Forms of attack

- Passive vs. Active

Threats posed to networks (how each is carried out // suitable examples):

- Malware
- Phishing
- Social engineering (people as the weak point in secure systems)
- Brute force attacks
- Denial of service attacks
- Data interception and theft
- The concept of SQL injection
- Poor network policy.

Identifying and preventing vulnerabilities:

- Penetration testing
- Network forensics
- Network policies
- Anti-malware software
- Firewalls
- User access levels
- Passwords
- Encryption
  - Symmetric
  - A-Symmetric

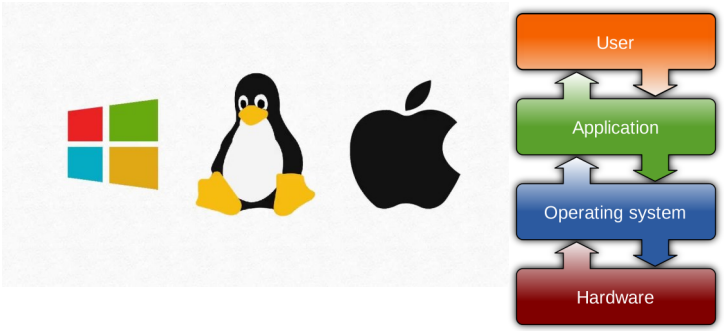
Keywords:

- **Malware**
- **Viruses**
- **Worms**
- **Trojan Horses**
- **Phishing**
- **Social Engineering**

System software

- Purpose and functionality of systems software

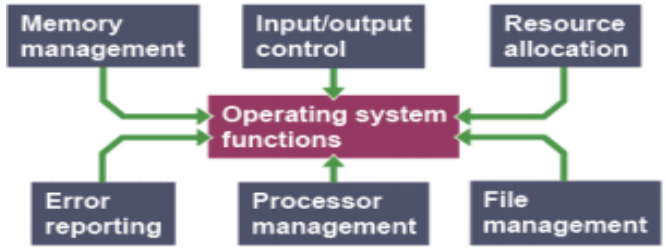
- Operating systems: →



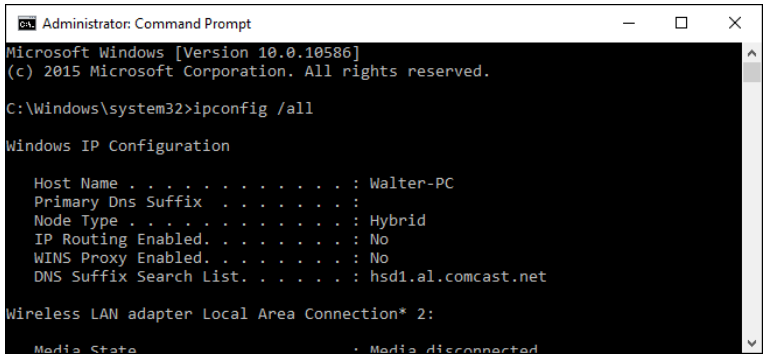
- User interface
- Memory management/multitasking
- Peripheral devices and drivers
- User management
- File management

- Utility system software:

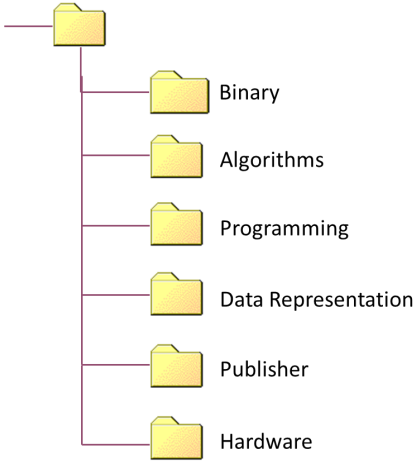
- Decryption software
- Defragmentation
- Data compression
- Role and methods of backup:
  - Full
  - Incremental.



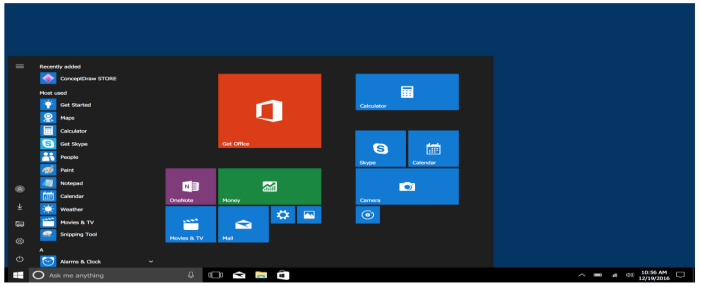
Windows Command prompt



File management



Windows GUI (Graphical User Interface)



Ethical, legal, cultural & environmental issues

- How to investigate & discuss Computer Science technologies while considering:
- Ethical issues
- Definition
- Examples

-Legal issues
- Definition
- Examples

- Cultural issues
- Definition
- Examples

- Environmental issues
- Definition
- Examples

- Privacy issues
- Definition
- Examples

- How key stakeholders are affected by technologies
- Environmental impact of Computer Science
- Cultural implications of Computer Science
- Open source vs proprietary software

Key legislation relevant to GCSE Computer Science
- The Data Protection Act 1998
- Computer Misuse Act 1990
- Copyright Designs and Patents Act 1988
- Creative Commons Licensing
- Freedom of Information Act 2000.

Command words/descriptive words you will see in your exam

Add: Join something to something else so as to increase the size, number, or amount.
Analyse: Break down in order to bring out the essential elements or structure. To identify parts and relationships, and to interpret information to reach conclusions.
Annotate: Add brief notes to a diagram or graph.
Calculate: Obtain a numerical answer showing the relevant stages in the working.
Compare: Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.
Complete: Provide all the necessary or appropriate parts.
Convert: Change the form, character, or function of something.
Define: Give the precise meaning of a word, phrase, concept or physical quantity.
Describe: Give a detailed account or picture of a situation, event, pattern or process
Design: Produce a plan, simulation or model.
Discuss: Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence.
Draw: Produce (a picture or diagram) by making lines and marks on paper with a pencil, pen, etc.
Evaluate: Assess the implications and limitations; to make judgements about the ideas, works, solutions or methods in relation to selected criteria.
Explain: Give a detailed account including reasons or causes.
Give: Present information which determines the importance of an event or issue. Quite often used to show causation.
How: In what way or manner; by what means.
Identify: Provide an answer from a number of possibilities. Recognise and state briefly a distinguishing factor or feature.
Justify: Give valid reasons or evidence to support an answer or conclusion.
Label: Add title, labels or brief explanation(s) to a diagram or graph.
List: Give a sequence of brief answers with no explanation.
Order: Put the responses into a logical sequence.
Outline: Give a brief account or summary.
Show: Give steps in a derivation or calculation.
Solve: Obtain the answer(s) using algebraic and/or numerical and/or graphical methods.
State: Give a specific name, value or other brief answer without explanation or calculation.

Tick: Mark (an item) with a tick or select (a box) on a form, questionnaire etc. to indicate that something has been chosen.

What: Asking for information specifying something.

Write/Rewrite: Mark (letters, words, or other symbols) on a surface, typically paper, with a pen, pencil, or similar implement/Write (something) again so as to alter or improve it.

J277/02: Computational thinking, algorithms & programming. 50% GCSE Total—1hour & 30 minutes written paper exam (no calculators allowed) 80 marks

- 2.1 Algorithms
- 2.2 Programming fundamentals
- 2.3 Producing robust programs
- 2.4 Boolean logic
- 2.5 Programming languages and

Please see course specification for further details HERE

Integrated development environment (IDE) tools:
editors, error diagnostics, run-time environment, translators.

Algorithms

Computational thinking:
- Abstraction
- Decomposition
- Algorithmic Thinking

Searching algorithms
- Binary search
- Linear search

Sorting algorithms
- Bubble sort
- Merge sort
- Insertion sort

Programming Techniques
variables, constants, operators, inputs, outputs and assignments

Programming constructs:
- Sequence
- Selection
- Iteration (FOR or WHILE loops)

File handling
open, read, write, close

Arrays:
1D & 2D—These are essentially lists/tables

Data types:
integer, real, Boolean, character and string

Operators

Comparison operators

==	Equal to
!=	Not equal to
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to

Arithmetic operators

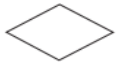
+	Addition e.g. x=6+5 gives 11
-	Subtraction e.g. x=6-5 gives 1
*	Multiplication e.g. x=12*2 gives 24
/	Division e.g. x=12/2 gives 6
MOD	Modulus e.g. 12MOD5 gives 2
DIV	Quotient e.g. 17DIV5 gives 3
^	Exponentiation e.g. 3^4 gives 81

Representing Algorithms

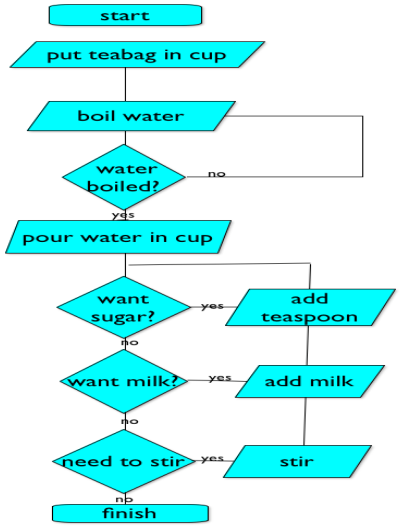
Algorithms can either be represented as a flowchart OR pseudocode unless specified in the exam.

OCR Pseudocode Guide: https://www.ocr.org.uk/Images/202654-pseudocode-guide.pdf

Common flowchart symbols:

	Line	An arrow represents control passing between the connected shapes.
	**Process**	This shape represents something being performed or done.
	**Sub Routine**	This shape represents a subroutine call that will relate to a separate, non-linked flow chart
	**Input/Output**	This shape represents the input or output of something into or out of the flow chart.
	**Decision**	This shape represents a decision (Yes/No or True/False) that results in two lines representing the different possible outcomes.
	**Terminal**	This shape represents the "Start" and "End" of the process.

Flowchart



Pseudocode

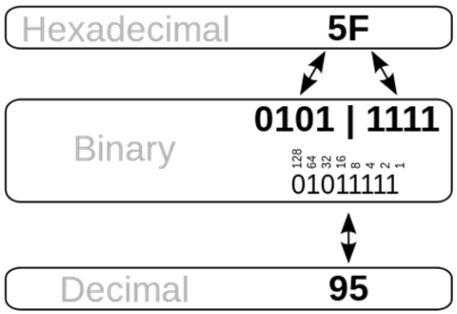
```
PROGRAM make tea

put teabag in cup

WHILE (water not boiled)
    boil water
    ENDWHILE
pour water in cup

WHILE (sugar needed)
    add sugar
ENDWHILE

WHILE (milk needed)
    add milk
ENDWHILE

WHILE (need to stir)
    stir tea
ENDWHILE

Server and finish
```

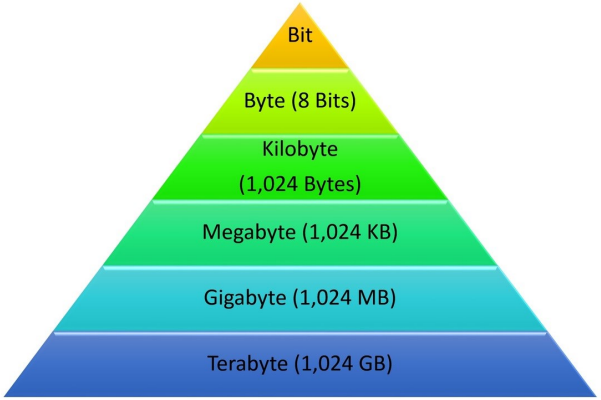
Data representation

Numbers

- Binary – base 2.
- Denary – base 10 (Our number system).
- Converting from binary to denary.
- Converting from denary to binary
- Adding binary numbers.
    - Overflow error

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15





Storage/units

bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte, petabyte—Conversion between these.

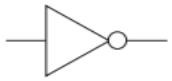
Computational logic

Boolean algebra

When Boolean algebra is used in questions, the notation described below will be used.

Notation used
∧ e.g. A ∧ B

Notation used:
∨ e.g. A∨B



Notation used:
¬ e.g. ¬A

A	B	A ∧ B
T	T	T
T	F	F
F	T	F
F	F	F

A	B	A∨B
T	T	T
T	F	T
F	T	T
F	F	F

A	¬A
T	F
F	T

Above are truth tables—1 or 0 can also be used to represent True or False

AND – Conjunction

Alternatives accepted:
AND e.g. A AND B e.g. A

OR - Disjunction

OR e.g. A OR B + e.g. A+B

NOT - Negation

bar e.g. A– ~ e.g. ~A
NOT e.g. NOT A

Characters

- The use of binary codes to represent characters
- The term 'character-set'
- The relationship between the number of bits per character in a character set and the number of characters which can be represented: ASCII, extended ASCII and Unicode.

Images

- How an image is represented as a series of pixels represented in binary
- Metadata
- The effect of colour depth and resolution on the size of an image file.

Sound

- How sound can be sampled and stored in digital form from analogue
- How sampling intervals and other factors affect the size of a sound file and the quality of its playback: **sample size, bit rate, sampling frequency.**

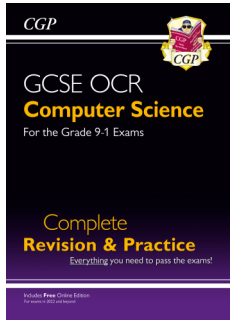
Compression

-Need for compression
-Lossy VS Lossless compression

Summarise the textbook with Chapter headings, sub headings etc. This will result in a quick reference text-book summarise in 10 or less pages. Alternatively you can get the course specification offline and write notes under each of the unit contents.

Seneca Learning

- Interactive revision! Note: topic numbers are not the same as course spec, you will need to cross reference.



CGP OCR J277 Revision books

You all have a copy.

Google classroom

All lesson PowerPoints that we have done in class on the R-Drive:

R:\computing

GCSE Bitesize – Computer Science

Exam reference language guide (Pseudocode)

In your course spec hyperlinked in this document.

Craig 'n' Dave YouTube channel:

https://www.youtube.com/channel/UC0HzEBLlJxlrwBAHJ5S9JQg

Quizlet

Make your own quizzes on Quizlet

https://quizlet.com/en-gb